JOURNAL OF ANIMAL SCIENCE
The Premier Journal and Leading Source of New Knowledge and Perspective in Animal Science

Relationship of milk yield and quality to preweaning gain of calves from Angus, Brahman and reciprocal-cross cows on different forage systems

M. A. Brown and A. H. Brown, Jr.

J Anim Sci 2002. 80:2522-2527.

Relationship of milk yield and quality to preweaning gain of calves from Angus, Brahman and reciprocal-cross cows on different forage systems[1,2,3]

M. A. Brown*[4] and A. H. Brown, Jr.†

*USDA, ARS, Grazinglands Research Laboratory, El Reno, OK 73036 and
†Department of Animal Science, University of Arkansas; Fayetteville 72701

ABSTRACT: Interactions of the regression of preweaning ADG on dam milk yield and quality with breed group and forage environment were evaluated in a two-phase study. Phase I consisted of milk yield and quality and calf gain records from 1989 to 1991 for purebred Angus (n = 64) and Brahman (n = 62) cows mated to sires of both breeds. Phase II consisted of milk yield and quality and calf gain records from 1991 to 1997 for Angus (n = 94), Brahman (n = 85), Angus × Brahman (n = 86) and Brahman × Angus (n = 93) mated to Polled Hereford sires. In Phase I, forage environments included common bermudagrass and endophyte-infected tall fescue. In Phase II, forage environments included common bermudagrass and endophyte-infected tall fescue (1991 to 1995) and a rotational system of both forages (1995 to 1997) in which each forage was grazed during its appropriate growing season, usually June through October for bermudagrass and November through May for tall fescue. Milk yield was estimated monthly six times during lactation from spring through fall and converted to a 24-h basis. Milk fat, milk protein, and somatic cell count were analyzed by a commercial laboratory. In Phase I, the relation of preweaning ADG to milk yield, milk fat yield, and protein yield was greater ($P < 0.05$) in Brahman cows on bermudagrass than Angus on bermudagrass. The regression of preweaning ADG on milk yield in Phase I was greater ($P < 0.05$) for cows on tall fescue than cows which grazed bermudagrass. In Phase II, the relation of preweaning ADG to milk yield, milk fat yield, and milk protein yield was greater or tended to be greater ($P < 0.01$, $P < 0.11$, $P < 0.01$, respectively) in purebred cows compared to reciprocal-cross cows. The regression of preweaning ADG on milk yield and milk protein yield was greater ($P < 0.05$) on tall fescue than bermudagrass in Phase II. These results suggest that the influence of milk yield and quality on calf growth may differ among breed types and production system, and the efficacy of genetic improvements in milk traits may depend on the breed type and forage environment.

Key Words: Aberdeen Angus, Beef Cattle, Brahman, Crossbreeding, Forage, Genotype Environment

 J. Anim. Sci. 2002. 80:2522–2527

Introduction

The maternal ability of beef cows has been shown to be a critical component of preweaning growth in their calves (Freking and Marshall, 1992; Fiss and Wilton, 1993; Mallinckrodt et al., 1993) and profit potential in the herd (Miller et al., 1999). Consequently, considerable emphasis has been given to improvements in maternal ability of beef cows. Although nutritional environment is an obvious factor influencing milk yield, little work has been done to evaluate the influence of both breed group and forage environment on the relationship of milk yield and preweaning growth. Moreover, more work is needed to evaluate the influence of milk fat and milk protein on preweaning growth in beef calves. Thus, our objectives in this research were to evaluate the interaction of the regression of calf preweaning ADG on milk yield, milk fat, milk protein, and somatic cell count with breed group and forage environment in Angus, Brahman, and reciprocal-cross cows and their calves managed on three different forage systems.

Materials and Methods

Nine years of milk production and calf growth data (1989 to 1997) on approximately 310 Angus, Brahman,

[1]Published with the approval of the director of the Arkansas Agricultural Experiment Station, Manuscript #01086.

[2]Mention of a trade name, proprietary product, or specific equipment does not constitute a guarantee or warranty by the USDA and does not imply approval to the exclusion of other products that may be suitable.

[3]Cooperation of the Arkansas Agric. Exp. Sta., Univ. of Arkansas is gratefully acknowledged as is the technical assistance of the employees of the Dale Bumpers Small Farms Research Center.

[4]Correspondence: 7207 W. Cheyenne (phone: 405-262-5291; fax: 405-262-0133; E-mail: mbrown@grl.ars.usda.gov).

Received January 14, 2002.
Accepted June 12, 2002.

Table 1. Sample size for milk yield and quality estimates for forage and dam breed subclasses for Phase I and Phase II

		Phase I, 1989-1991		Phase II, 1991-1997			
Forage	Breed:	AA[a]	BB	AA	AB	BA	BB
Bermuda		32	32	41	37	42	38
Fescue		32	30	41	37	39	35
Rotation		—	—	12	12	12	12

[a]A = Angus, B = Brahman, sire breed listed first.

and reciprocal-cross cow-calf pairs managed on common bermudagrass (*Cynodon dactylon,* [L]. Pers.), endophyte-infected tall fescue (*Festuca arundinacea* Schreb.), or a combination of the two forages was evaluated in this study. Data from 1989 to 1991 consisted of purebred Angus and Brahman cows and their purebred and reciprocal-cross calves managed on either common bermudagrass or endophyte-infected tall fescue. Data from 1991 to 1994 were from Angus, Brahman, and reciprocal-cross cows, and their Polled Hereford-sired calves managed on either common bermudagrass or endophyte-infected tall fescue. Data from 1995 to 1997 were from Angus, Brahman, and reciprocal-cross cows, and their Polled Hereford-sired calves managed on either common bermudagrass, endophyte-infected tall fescue, or a combination of the two forages in which each forage was grazed during its appropriate season, usually June through October for bermudagrass and November through May for tall fescue. Milk yield was estimated monthly six times during lactation from spring through fall by method of single-cow milking machine and converted to a 24-h basis ([milk weight/14 h] × 24 h; Brown et al., 1996). Average days postpartum for estimates were 65, 94, 122, 151, 173, and 199 d from 1989 to 1991 and 60, 89, 116, 145, 172, and 199 d from 1991 to 1997. Milk fat, milk protein, and somatic cell count were analyzed by a commercial laboratory using a Milkoscan System 4000 (Foss North America, Eden Prairie, MN; AOAC, 1990). Details on herd and pasture management and milking procedures can be found in Brown et al. (1993), Brown et al. (1996), and Brown et al. (2001). Because the data in 1989 to 1991 consisted of the production of purebred and reciprocal-cross calves from Angus and Brahman sires and the data from 1991 to 1997 were the production of two- and three-breed cross calves from Polled Hereford sires, data were reported separately from 1989 to 1991 (Phase I) and from 1991 to 1997 (Phase II). Sample sizes for each phase are given in Table 1.

Data were analyzed by methods of mixed model least squares. Linear models for 1989 to 1991 included the fixed effects of year, sire breed, dam breed, sex of calf, forage, and interactions among fixed effects; random effects included sire of calf nested in sire breed and the pooled interactions of sire in sire breed with fixed effects. Linear models for 1991 to 1997 included the fixed effects of year, maternal grandsire breed, maternal granddam breed, sex of calf, age of dam, forage, and interactions among fixed effects; random effects included sire of calf and the pooled interactions of sire with fixed effects. Linear contrasts for calf preweaning ADG and cow milk traits among fixed effects were done using "t" statistics. The linear contrast for maternal heterosis for calf preweaning ADG contrasted the average of calves from cross bred cows with the average of calves from purebred cows. Linear contrasts for heterosis for milk traits contrasted the average performance of crossbred cows with the average performance of purebred cows. Covariates for evaluation of the relationship of calf preweaning ADG to milk traits included in separate models were 24-h milk yield, 24-h milk fat yield, 24-h milk protein yield, and somatic cell count, as well as interactions of these covariates with sire breed, dam breed, forage, sire breed × dam breed, sire breed × forage, dam breed × forage, and sire breed × dam breed × forage. Contrasts among regression coefficients for different classes were done using "t" statistics.

Results and Discussion

Breed and Forage Effects for Traits Analyzed

Least squares means and standard errors for traits analyzed are given in Tables 2 and 3 for Phase I and Phase II, respectively. In Phase I, calf preweaning ADG was less ($P < 0.01$) on tall fescue than bermudagrass. An interaction ($P < 0.05$) between breed of dam and forage was noted. Angus cows grazing tall fescue paddocks produced less milk ($P < 0.05$) than their Angus contemporaries grazing bermudagrass paddocks, while forage differences were not evident in Brahman cows. Also, in Phase I, cow breed and forage type influenced milk fat yield ($P < 0.01$) as Brahman cows produced more milk fat than Angus cows, and bermudagrass grazing allowed more milk fat production than tall fescue grazing. Similar to milk yield, milk protein yield was greater ($P < 0.01$) in Angus on bermudagrass than Angus on tall fescue but similar in Brahman on tall fescue and bermudagrass. In Phase I, forage effects for somatic cell counts were similar in Angus, but Brahman on tall fescue had greater counts than Brahman on bermudagrass ($P = 0.05$). In Phase II, there was an interaction ($P < 0.05$) of grandsire breed × granddam breed × forage for preweaning ADG. Maternal heterosis in preweaning ADG was larger ($P < 0.05$) on tall fescue (0.18 kg, $P < 0.01$) than bermudagrass (0.11 kg, $P < 0.01$) but similar in tall fescue and the rotational system (0.17 kg, $P < 0.01$) (data not shown). Bermudagrass grazing allowed cows to produce the greatest milk yields ($P < 0.01$) when compared to tall fescue or the rotational system, yet cows grazing the rotational forage system had greater 24-h milk yields than those grazing only tall fescue ($P < 0.01$). Heterosis for milk yield was similar in all forage systems ($P > 0.26$) and averaged 2.2 kg ($P < 0.01$, data not shown). Milk fat yield differed ($P < 0.05$) among all of the forage systems and was largest on bermudagrass, intermediate on the rotational system, and lowest on tall fescue. Heterosis

Table 2. Least squares means and standard errors for breed of dam × forage subclasses for calf growth and milk traits, Phase I

Breed and forage	Preweaning ADG[a]	24-h Milk yield[b]	24-h Milk fat[b]	24-h Milk protein[b]	Somatic cells[c]
Angus					
Bermuda	0.92 ± 0.02	6.65 ± 0.34	224 ± 14	215 ± 11	165 ± 52
Tall Fescue	0.84 ± 0.02	4.82 ± 0.34	148 ± 14	158 ± 11	108 ± 52
Brahman					
Bermuda	0.90 ± 0.02	6.13 ± 0.33	251 ± 14	208 ± 11	158 ± 51
Tall Fescue	0.84 ± 0.02	5.72 ± 0.34	210 ± 15	189 ± 11	304 ± 51
Approx. $LSD_{0.10}$[b]	0.05	0.78	33	26	120
Approx. $LSD_{0.05}$[d]	0.06	0.94	39	30	143

[a]Kilograms per day.
[b]Grams per 24 h.
[c]× 10^3 cells.
[d]Approximate LSD is for comparison within or between breed group × forage subclass means.

for milk fat yield tended ($P < 0.10$) to be greater in cows on bermudagrass (86 g, $P < 0.01$) than heterosis on tall fescue (50 g, $P < 0.01$) (data not shown). Milk protein yield differed ($P < 0.01$) among the forages and was highest on bermudagrass, intermediate on the rotational system, and lowest on tall fescue. Heterosis for milk protein yield was similar among forages ($P > 0.37$) and averaged 76 g ($P < 0.01$) (data not shown). There was little evidence of forage differences in somatic cell count, but heterosis was evident with somatic cell count in crossbred cows lower (–89,984 cells/mL, $P < 0.05$) than counts in purebreds (data not shown).

Regression of Preweaning ADG on 24-h Milk Yield

Estimates of the regression of preweaning ADG on 24-h milk yield and their standard errors for Phase I and Phase II are given in Table 4. In Phase I there was little evidence of an interaction of 24-h milk yield with sire breed. There was, however, evidence of an interaction (*P*

Table 3. Least squares means and standard errors for breed of grandsire × breed of granddam × forage subclasses for calf growth and milk traits, Phase II

Breed and forage		Preweaning ADG[a]	24-h Milk yield[b]	24-h Milk fat[b]	24-h Milk protein[b]	Somatic cells[c]
Angus						
Bermuda		0.88 ± 0.02	6.97 ± 0.29	249 ± 13	221 ± 9	210 ± 52
Tall Fescue		0.63 ± 0.02	4.09 ± 0.29	133 ± 13	132 ± 9	311 ± 52
Rotation		0.74 ± 0.04	5.50 ± 0.56	203 ± 26	179 ± 18	278 ± 101
Angus × Brahman						
Bermuda		1.06 ± 0.02	9.37 ± 0.30	373 ± 14	309 ± 10	205 ± 54
Tall Fescue		0.91 ± 0.02	6.62 ± 0.30	222 ± 14	217 ± 10	159 ± 54
Rotation		1.01 ± 0.04	8.47 ± 0.56	307 ± 26	283 ± 18	178 ± 101
Brahman × Angus						
Bermuda		1.09 ± 0.02	9.99 ± 0.28	371 ± 13	335 ± 9	130 ± 51
Tall Fescue		0.94 ± 0.02	6.82 ± 0.29	239 ± 13	236 ± 9	109 ± 52
Rotation		1.02 ± 0.04	9.17 ± 0.57	355 ± 26	315 ± 19	121 ± 102
Brahman						
Bermuda		1.05 ± 0.02	7.74 ± 0.29	324 ± 13	268 ± 9	199 ± 52
Tall Fescue		0.87 ± 0.02	5.83 ± 0.30	227 ± 14	195 ± 10	185 ± 54
Rotation		0.96 ± 0.04	7.03 ± 0.56	297 ± 26	245 ± 18	259 ± 101
Approx. $LSD_{0.10}$[e]	Within bermuda/fescue	0.05	0.68	31	22	122
Approx. $LSD_{0.05}$[e]	Within bermuda/fescue	0.06	0.81	37	26	146
Approx. $LSD_{0.10}$[f]	Rotation vs bermuda/fescue	0.07	1.04	48	34	188
Approx. $LSD_{0.05}$[f]	Rotation vs bermuda/fescue	0.09	1.24	57	40	224
Approx. $LSD_{0.10}$[g]	Within rotation	0.09	1.31	60	42	236
Approx. $LSD_{0.05}$[g]	Within rotation	0.11	1.56	72	51	281

[a]Kilograms per day.
[b]Grams per 24 h
[c]× 10^3 cells.
[d]Angus = Angus grandsire × Angus granddam; Angus × Brahman = Angus grandsire × Brahman granddam; Brahman × Angus = Brahman grandsire × Angus granddam; Brahman = Brahman grandsire × Brahman granddam.
[e]Approximate LSD is for comparison between breed group × forage subclass means within bermudagrass and fescue.
[f]Approximate LSD is for comparison between breed group × forage subclass means between rotation and bermudagrass or fescue.
[g]Approximate LSD is for comparison between breed group within rotation.

Table 4. Regression coefficients and standard errors for preweaning ADG on average milk yield for Angus and Brahman cows on common bermudagrass or endophyte-infected tall fescue, (g/kg)

	Phase I, 1989-1991			Phase II, 1991-1997				
Forage	AA[a]	BB	Forage avg	AA[a]	AB	BA	BB	Forage avg
Bermuda	11.7 ± 11.3[v]	46.6 ± 11.5[w]	29.1 ± 8.1	39.6 ± 7.4	33.8 ± 7.6	20.0 ± 7.8	30.7 ± 7.4	31.0 ± 3.9[x]
Tall fescue	40.2 ± 13.6	31.5 ± 11.2	35.9 ± 8.7	63.7 ± 9.0	31.8 ± 7.0	29.2 ± 7.9	53.4 ± 9.8	44.5 ± 4.6[y]
Rotation	—	—	—	51.9 ± 11.6	24.1 ± 10.8	19.3 ± 10.3	49.2 ± 17.8	36.1 ± 7.2[xy]
Breed avg	25.9 ± 8.8	39.1 ± 8.0	—	51.7 ± 5.6[x]	29.9 ± 5.3[yz]	22.8 ± 5.5[y]	44.4 ± 7.5[xz]	—

[a]A = Angus, B = Brahman, sire breed listed first.
[vw]Phase I subclass or main effect means in the same row or column with differing superscripts differ ($P < 0.05$).
[xyz]Phase II main effect means in the same row or column with differing superscripts differ ($P < 0.05$); subclass means not tested.

< 0.10) of the relation of preweaning ADG to milk yield with dam breed and forage. On bermudagrass, preweaning ADG increased 46.6 g per kg milk in calves from Brahman cows ($P < 0.01$), whereas the same relationship in calves from Angus cows was 11.7 g per kg milk ($P >$ 0.30). On tall fescue, the relationship was similar for calves from both breeds ($P = 0.63$). In the Phase II data there was evidence that the regression of preweaning ADG on 24-h milk yield was different among grandsire breed × granddam breed subclasses ($P < 0.01$) and among forage classes ($P < 0.10$). The regression pooled across pasture types was greater ($P < 0.01$) in calves from Angus than calves from Angus × Brahman and Brahman × Angus cows. The regression was also greater ($P < 0.05$) in calves from Brahman than Brahman × Angus cows. Consequently, the regression was generally greater for calves from purebred cows than from crossbred cows with the average slope for calves from purebreds exceeding that of calves from crossbreds by 21.7 g ADG per kg milk ($P < 0.01$). The regression of preweaning ADG on milk yield was greater ($P < 0.05$) on tall fescue compared to bermudagrass in Phase II where the regression on rotation was intermediate to the other two forage systems and not significantly different from either. Clutter and Nielsen (1987) reported low milk output cows had greater regression coefficients for 205-d calf gain than their high milk output contemporaries. Results from Fiss and Wilton (1993) agree that the regression of preweaning gain on milk yield was greater in low-milk-producing breeding systems than systems with greater levels of milk production. Mallinckrodt et al. (1993) reported greater regressions of calf weaning weight on milk yield in Herefords than Simmental, where milk yield in Herefords was lower than Simmental. Conversely, Marston et al. (1992) reported regression of weaning weight on total milk yield was larger in calves from Simmental than in calves from Angus, where total milk yield was greater in the Simmental. Miller et al. (1999) did not find differences among a large rotation group, small rotation group, and Herefords in the regression of preweaning ADG on daily milk yield, even though the Herefords were substantially lower in milk yield. McMorris and Wilton (1986) suggested that in cows with lower levels of milk production, calves utilize most of the milk produced, whereas in cows with greater levels of production, milk is produced in excess of what can be utilized by the calves. Clutter and Nielsen (1987) also suggested that calves on dams with low milk production potential made better use of what milk was available. The data from the current study support the hypothesis of stronger relationships of milk yield to preweaning ADG in lower producing cows where purebred cows had lower milk yield than crossbreds and where cows on endophyte-infected tall fescue had lower milk yields than cows on bermudagrass. However, the relationship of milk yield to preweaning ADG was greater in Phase I calves from Brahman cows than calves from Angus cows on bermudagrass, even though differences in milk yield were not significant.

Regression of Preweaning ADG on 24-h Milk Fat Yield

Estimates of the regression of preweaning ADG on 24-h milk fat yield and their standard errors for Phase I and Phase II are given in Table 5. There was an interaction of the regression of preweaning ADG on milk fat yield with dam breed and forage type ($P < 0.05$). The relationship was greater ($P < 0.05$) in calves from Brahman cows than calves from Angus cows on bermudagrass (927.1 vs 126.6 g/kg, respectively), whereas the relationship in calves from the two breeds was similar on tall fescue ($P = 0.59$). In Phase II, the regression of preweaning ADG on milk fat yield, pooled over pasture types, was greater ($P <$ 0.05) in calves from Angus than from Angus × Brahman, Brahman × Angus, and Brahman cows. The relationship in calves from Angus × Brahman was larger ($P < 0.10$) than the relationship in calves from Brahman × Angus. Additionally, the average regression of preweaning ADG on milk fat yield tended to be greater ($P < 0.11$) for calves from purebreds than from crossbreds. Although the relationship between preweaning ADG and milk fat yield, averaged across breed types, was not significantly different among forages ($P > 0.56$), the relationship for calves on tall fescue was numerically greater than bermudagrass or the rotational system. Beal et al. (1990) reported milk fat intake to be positively associated with preweaning gain. Marston et al. (1992) reported a greater association of absolute amounts of milk fat to adjusted weaning weight in Angus cows compared to Simmental where Angus produced less milk. This is consistent with

Table 5. Regression coefficients and standard errors for preweaning ADG on milk fat yield for Angus and Brahman cows on common bermudagrass or endophyte-infected tall fescue (g/kg)

	Phase I, 1989-1991			Phase II, 1991-1997				
Forage	AA[a]	BB	Forage avg	AA[a]	AB	BA	BB	Forage avg
Bermuda	126.6 ± 224.4^{v}	927.1 ± 232.1^{w}	526.8 ± 163.0	913.4 ± 208.2	631.4 ± 156.5	400.7 ± 193.6	597.2 ± 173.3	635.7 ± 94.2
Tall fescue	776.8 ± 258.3^{w}	582.3 ± 250.8^{w}	679.5 ± 181.7	1,227.9 ± 224.1	665.4 ± 174.7	313.1 ± 163.7	703.6 ± 207.9	727.5 ± 105.3
Rotation	—	—	—	859.1 ± 274.7	581.2 ± 304.5	346.5 ± 212.5	170.4 ± 614.6	489.3 ± 205.9
Breed avg	451.7 ± 170.9	754.7 ± 169.0	—	1,000.0 ± 137.2^{x}	626.0 ± 128.6^{y}	353.4 ± 110.4^{z}	490.4 ± 224.0^{yz}	—

[a]A = Angus, B = Brahman, sire breed listed first.
[vw]Phase I subclass or main effect means in the same row ($P < 0.05$) or column ($P < 0.10$) with differing superscripts differ.
[xyz]Phase II main effect means in the same row or column with differing superscripts differ ($P < 0.05$, except AB vs BA, $P < 0.10$); subclass means not tested.

Table 6. Regression coefficients and standard errors for preweaning ADG on milk protein yield for Angus and Brahman cows on common bermudagrass or endophyte-infected tall fescue (g/kg)

	Phase I, 1989-1991			Phase II, 1991-1997				
Forage	AA[a]	BB	Forage avg	AA[a]	AB	BA	BB	Forage avg
Bermuda	376.1 ± 309.7^{v}	1,373.9 ± 347.1^{w}	875.0 ± 234.6	1,380.5 ± 264.6	898.9 ± 210.4	427.7 ± 233.9	896.5 ± 212.1	900.9 ± 119.4^{x}
Tall fescue	1216.8 ± 467.4	884.7 ± 309.0	1,050.8 ± 277.7	1,950.9 ± 299.4	1,011.1 ± 222.2	890.5 ± 231.8	1,480.0 ± 281.1	1,333.1 ± 141.7^{y}
Rotation	—	—	—	1,719.6 ± 380.7	926.1 ± 364.0	633.4 ± 344.7	1,333.9 ± 588.9	1,153.2 ± 248.3^{y}
Breed avg	796.5 ± 279.3	1,129.3 ± 232.3	—	1,683.6 ± 186.8^{x}	945.4 ± 169.6^{yz}	650.5 ± 173.7^{y}	1,236.8 ± 243.0^{xz}	—

[a]A = Angus, B = Brahman, sire breed listed first.
[vw]Phase I subclass or main effect means in the same row or column with differing superscripts differ ($P < 0.05$).
[xyz]Phase II main effect means in the same row or column with differing superscripts differ ($P < 0.05$); subclass means not tested.

results from the current study in the lower milking groups of cows.

Regression of Preweaning ADG on 24-h Milk Protein Yield

Estimates of the regression of preweaning ADG on 24-h milk protein yield and their standard errors for Phase I and Phase II are given in Table 6. The regression of preweaning ADG on milk protein yield differed ($P < 0.10$) among dam breed × forage subclasses in Phase I. On bermudagrass, preweaning ADG increased 1373.9 g per kg increase in milk protein in calves from Brahman cows ($P < 0.01$), but only 376.1 g per kg increase in milk protein in calves from Angus cows ($P > 0.23$). In Phase II, there was an interaction ($P < 0.01$) of milk protein yield with grandsire breed × granddam breed and a tendency for an interaction with forage ($P < 0.10$). The regression of preweaning ADG on milk protein yield, averaged across forage types, was greater ($P < 0.01$) in calves from Angus cows than those from Angus × Brahman and Brahman × Angus ($P < 0.01$), whereas the relationship was greater ($P < 0.10$) in calves from Brahman cows than in calves from Brahman × Angus cows. Similar to the other two traits, the relationship was greater ($P < 0.01$) in the average of calves from purebred cows compared to the average of calves from crossbreds cows. The regression of preweaning ADG on milk protein yield was greater ($P < 0.05$) in tall fescue than bermudagrass. Results from Beal et al. (1990) showed milk protein intake to be positively associated with preweaning gain. Comparing Angus to Simmental, where milk yield in Angus was lower, Marston et al. (1992) reported a greater association of absolute amounts of milk protein to adjusted weaning weight in Angus. This is consistent with results from the current study in the lower milking groups of cows.

Regression of Preweaning ADG on Somatic Cell Count

There was little evidence of a relationship of somatic cell count to preweaning ADG in these data (data not shown). Estimates calculated were –0.00001 ($P > 0.88$) and –0.00004 ($P > 0.28$) kg per 1,000 somatic cell increase in Phase I and Phase II, respectively. Simpson et al. (1995) reported calf weaning weights were not affected by differences in dam somatic cell counts. Brown et al. (1998) reported negative relationships between somatic cell count and weaning weight, but the results were not statistically significant.

Implications

Phenotypic improvements in milk yield, yield of milk fat, and yield of milk protein are associated with improvements in preweaning ADG in beef cattle. However, the magnitude of the association appears to be less in breed groups or environments that support greater milk production. Consequently, further improvements in breeds and(or) environments where milk production is at relatively high levels may be less efficacious than improvements in breeds and(or) environments at lower levels of milk production. It is possible that improvements in productivity may be possible, even at greater levels of milk production, in certain genotypes and environments. Therefore, matching animal genotype to environment remains a consideration.

Literature Cited

AOAC. 1990. Official Methods of Analysis. 15th ed. Association of Official Analytical Chemists, Arlington, VA.

Beal, W. E., D. R. Notter, and R. M. Akers. 1990. Techniques for estimation of milk yield in beef cows and relationships of milk yield to calf weight and postpartum reproduction. J. Anim. Sci. 68:937–943.

Brown, M. A., A. H. Brown, Jr., W. G. Jackson, and J. R. Miesner. 1996. Milk production in Angus, Brahman, and reciprocal-cross cows grazing common bermudagrass or endophyte-infected tall fescue. J. Anim. Sci. 74:2058–2066.

Brown, M. A., A. H. Brown, Jr., W. G. Jackson, and J. R. Miesner. 2001. Genotype × environment interactions in milk yield and quality in Angus, Brahman, and reciprocal-cross cows on different forage systems. J. Anim. Sci. 79:1643–1649.

Brown, M. A., I. Duenas, M. Paape, W. G. Jackson, J. R. Miesner, and A. H. Brown, Jr. 1998. Evaluation of mastitis-causing organisms in Angus, Brahman, and reciprocal-cross cows grazing endophyte-infected tall fescue and/or common bermudagrass. Prof. Anim. Sci. 14:127–132.

Brown, M. A., L. M. Tharel, A. H. Brown, Jr., W. G. Jackson, and J. R. Miesner. 1993. Milk production in Brahman and Angus cows on endophyte-infected fescue and common bermudagrass. J. Anim. Sci. 71:1117–1122.

Clutter, A. C., and M. K. Nielsen. 1987. Effect of level of beef cow milk production on pre- and postweaning calf growth. J. Anim. Sci. 64:1313–1322.

Fiss, C. F., and J. W. Wilton. 1993. Contribution of breed, cow weight, and milk yield to the preweaning, feedlot, and carcass traits of calves in three beef breeding systems. J. Anim. Sci. 71:2874–2884.

Freking, B. A., and D. M. Marshall. 1992. Interrelationships of heifer milk production and other biological traits with production efficiency to weaning. J. Anim. Sci. 70:646–655.

Mallinckrodt, C. H., R. M. Bourdon, B. L. Golden, R. R. Schalles, and K. G. Odde. 1993. Relationship of maternal milk expected progeny differences to actual milk yield and calf weaning weight. J. Anim. Sci. 71:355–362.

Marston, T. T., D. D. Simms, R. R. Schalles, K. O. Zoellner, L. C. Martin, and G. M. Fink. 1992. Relationship of milk production, milk expected progeny difference, and calf weaning weight in Angus and Simmental cow-calf pairs. J. Anim. Sci. 70:3304–3310.

McMorris, M. R., and J. W. Wilton. 1986. Breeding system, cow weight, and milk yield effects on various biological variables in beef production. J. Anim. Sci. 63:1361–1372.

Miller, S. P., J. W. Wilton, and W. C. Pfeiffer. 1999. Effects of milk yield on biological efficiency and profit of beef production from birth to slaughter. J. Anim. Sci. 77:344–352.

Simpson, R. B., D. P. Wesen, K. L. Anderson, J. D. Armstrong, and R. W. Harvey. 1995. Subclinical mastitis and milk production in primiparous Simmental cows. J. Anim. Sci. 73:1552–1558.